REMARKS

Reconsideration and allowance of this application, as amended, is respectfully requested.

This amendment is in response to the Office Action dated November 12, 2003.

By the present amendment, the Title has been amended in response to the objection made to the Title in paragraph 3 of the Office Action. In addition, claim 31 has been amended to correct the typographical error noted in the objection set forth in paragraph 2 of the Office Action. Therefore, removal of these objections is respectfully requested. Also by the present amendment, claim 50 has been amended to provide proper antecedent basis in response to the 35 U.S.C. § 112, second paragraph, rejection. Therefore, reconsideration and removal of this rejection, as well, is also respectfully requested. Finally, new claims 54-60 have been added to further define the invention, as will be discussed below.

Briefly, the present invention is directed to a problem discussed on page 4, line 13 et seq. of the specification that it is difficult to provide test element groups (TEGs) to determine the occurrence of a failure in a semiconductor product or a decrease in yield. In particular, as discussed on page 3, line 26 through page 4, line 12, only a limited space is available in conventional devices for the formation of said TEGs within a scribe area within a wafer used for forming a plurality of chips.

Fig. 1 shows an overall arrangement of a semiconductor wafer SW having a plurality of scribe lines SL used for forming individual semiconductor chips CP. Figs. 2A and 2B show a first embodiment of the invention in which a first scribe line SL1 is 100 μm in width and includes a plurality of TEGs therein. As discussed on page 7,

line 21 et seq., these TEGs are formed to include first rectangular pads (for example, of a size of 10 μm or less) in the first scribe area SL1. Fig. 2B shows the location of bonding pads BP2 and more TEGs with second electrode pads (having a size of 20 μm or less, as discussed on page 7, line 21 et seq.) in a second scribe line area SL2. A cross-sectional view of the first scribe line area SL1 can be found in Fig. 5 while a cross-sectional view of the second scribe line area SL2 can be found in Fig. 8.

Referring to Fig. 5 showing the first scribe line area SL1, it can be seen that on one side of the first scribe line SL1, a product circuit region A is provided for an MOS circuit (as described beginning on page 24). In this product circuit region A, a exposed bonding pad BP3 is provided for a test probe. Fig. 5 also shows a product circuit area B in which an RC circuit can be formed. Guard bands GB are interposed between the scribe line region SL1 and the product circuit regions A and B.

Page 15 through 18 describe a method for measuring used in conjunction with the structure shown in Figs. 2, 5, and 8. The steps shown in Fig. 15 and illustrated in Figs. 16-18 are discussed, for example, beginning on page 43. In particular, as noted in Fig. 15, first a surface of a bonding pad of the TEG is exposed in a step 100. Following this, in step 102, a nanoprobe is contacted to the exposed pad. This can be seen, for example, in Fig. 18 with the nanoprobes NP contacting bonding pads.

As discussed on page 46, lines 9 through 15, by virtue of the present arrangement with the small electrode pads utilized for the TEG (as shown in Figs. 2A and 2B), it is possible to locate a large number of TEGs in the relatively small scribe regions of the wafer. As a result, the present invention permits obtaining a large

amount of data from evaluating characteristics of the TEGs to improve yield and mass production.

Reconsideration and allowance of claims 31 and 32 over Kim (USP 6,159,826) is respectfully requested. Independent claim 31 defines the features of forming rectangular first electrode pads having side lengths of 10 μm or shorter and forming a bonding pad comprised of an uppermost wiring layer in a product circuit region. A protection film is then formed on an upper layer of the uppermost layer wiring, and the surface of the bonding pad is then partially exposed by removing a predetermined part of the protection film. As such, claim 31 provides a combination of electrode pads having a very small side length of 10 μm or shorter in combination with a partially exposed bonding pad. This can be read, solely for purposes of example, on the small rectangular electrode pads shown in Figs. 2A and 5, and discussed on page 7, line 21 et seq. of the specification. The second electrode pads having a side length of 20 μm or longer shown in claim 32 can be read on the electrode pads for the TEG shown in Fig. 2B (as also discussed on page 7, line 21 et seq.).

Turning to the Kim reference, Kim discloses a much larger rectangular pad having side dimensions of 100 μm formed within a scribe region having a width of about 150 μm (e.g. see column 3, lines 15-25). As such, these pads are much larger than the pads defined by the present claims. As a result, Kim suffers from the problem discussed on page 4, line 7 et seq. for prior art devices that the large side length greatly limits the number of TEGs that can be formed in the scribe region. This results in an inability to adequately detect the occurrence of failure or reductions in yield of the semiconductor product. Accordingly, by virtue of the combination of

features defined in claim 31, including the use of first electrode pads having a side length of 10 μm or shorter, in conjunction with the partially exposed bonding pad, a much larger number of TEGs can be arranged in the small area of the scribe line than would be the case in Kim. Accordingly, as discussed on page 46, much more information can be obtained to provide improved detection of failure and reductions in yield. Therefore, reconsideration and allowance of claims 31 and 32 over Kim is earnestly solicited.

Reconsideration and allowance of claims 36-39, 49 over the combination of Kim in view of Marcus (USP 5,475,318) and Sugasawara (USP 5,936,876) is also respectfully requested. These claims all contain similar features to those discussed above with regard to claim 31. In addition, these claims define further features such as providing a plurality of TEGs with the first electrode pads in the scribe region and contacting a probe having a small tip radius to the electrode pads so that the TEG can be measured. Claim 36, for example, defines a very short side length of 0.5 μm for the first electrode pads. As such, these claims 36-49 even further define over Kim by virtue of the further specific details provided concerning the contacting of the first rectangular electrode pads with a probe having the small tip radius of curvature.

In the Office Action, Marcus is cited with regard to specific teachings concerning a small probe. Although Marcus does teach utilizing a small probe, the fact is that Marcus adds nothing to teach or suggest the specific details regarding the electrode pad size which are lacking in the Kim reference to begin with. Therefore, even if one were to combine the teachings of Marcus and Kim, the end result would still fail to teach the features of the first electrode pad size specifically defined by these claims. Similarly, Sugasawara adds nothing to overcome the shortcomings of

Kim or Marcus in meeting these features of the present claims. Therefore, reconsideration and allowance of claims 36-49 over Kim, Marcus and Sugasawara is also respectfully requested.

Appreciation is expressed to the Examiner for the indication of allowable subject matter in claims 50-53. By the present amendment, as noted above, claim 50 has been amended to overcome the 35 U.S.C. § 112, second paragraph, rejection. Accordingly, reconsideration and allowance of claims 50-53, together with the other pending claims 31, 32, 36-49 is respectfully requested.

Reconsideration and allowance of the dependent claims 54-60 is also respectfully requested. These new dependent claims define further features of the invention over the cited prior art. For example, claims 54 and 56-60 all define that the probe contains tungsten as a main component. It is noted that this distinguishes over the probe of the Marcus reference. Specifically, Marcus teaches that a base for sustaining a probe is formed by having an aluminum layer and a silicon oxide layer which have different thermal expansion coefficients (e.g. see column 3, line 67 through column 4, line 1). Marcus further discloses that the probe is formed of silicon, with the tip thereof having a radius of 1 nm or less (see column 3, lines 59-63). Dependent claims 54 and 56-60, on the other hand, now define the formation of the probe with tungsten, which is much harder than silicon. It is also noted that the tip radius of curvature for the probes as defined in the parent claims as 0.05 μm to 0.8 μm. As such, the tungsten probe defined in the dependent claims 54 and 56-60 is considerably stronger than the silicon probe utilized in Marcus. Accordingly, these claims, in combination with the features defined in their respective parent claims, even further define over the prior art.

New dependent claim 55 further defines allowed claim 50 in defining that the logic circuits in question are TEG elements. Accordingly, allowance of new dependent claims 54 and 55 (both dependent on allowed claim 50) is respectfully requested.

If the Examiner believes that there are any other points which may be clarified or otherwise disposed of either by telephone discussion or by personal interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Antonelli, Terry, Stout & Kraus, LLP Deposit Account No. 01-2135 (Docket No. 843.41106X00), and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By _____
Gregory E. Montone
Reg. No. 28,141

GEM/dlt

1300 North Seventeenth Street, Suite 1800
Arlington, Virginia 22209
Telephone: (703) 312-6600
Facsimile: (703) 312-6666